Ordered Mesoporous (Organo)Silica Particles as Packing Material in RPLC: Increasing Retention and Improving Particle Stability.

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Ordered mesoporous silica materials were firstly developed in 1992 by the Mobil Oil Company. Since that date the range of related materials has been continuously increasing, from small (2 – 3 nm) ordered hexagonal and cubical pore systems, up to 10 and even 30 nm ordered pore structures. They are called MCM[1] (Mobil Composition of Matter), SBA[2] (University of Santa Barbara) or PMO[3] (Periodic Mesoporous Organosilica) materials. Due to their high surface areas (between 700 and 1600 m²/g), larger pore volumes (0.7 – 1.2 mL/g) and because of the high degree of order in the pores (hexagonal or cubic), they are applicable in a wide range of areas.

Their high ordered porosity leads to a doubling of the retention factor when these columns are compared to several commercial high performance columns.

Micrometer sized spherical mesoporous MCM-41 type particles were synthesized to use as a packing material for High Performance Liquid Chromatography. Spray drying was used for the synthesis of the particles as this enables easy up scaling. The entire synthetic procedure was optimized to ensure optimum particle morphology while preserving a high surface area and acceptable yields. The materials were subsequently treated with a C-18 silane in a grafting procedure for reversed phase LC application and packed into columns.

A doubling in retention time was observed compared to conventional commercial HPLC columns of the same dimensions. This could be related to a much increased accessible surface in the pores compared to conventional HPLC materials with random pore sizes. The obtained columns remained stable during the entire series of HPLC analysis to which they were subjected (>300 runs) [4]

PMO materials have an additional advantage when compared to pure silica. Apart from their large surface area, they possess an organic group between two silicon atoms. This leads to increased hydrolytical stability and extended life expectancy of the columns.

[1] Kresge, C.T.; Leonowicz, M.E.; Roth, W.J.; Vartuli, J.C.; Beck, J.S. *Nature* **1992**, *359*, 710-712. [2] Zhao, D.Y.; Feng, J.L.; Huo, Q.S.; Melosh, N.; Frederickson, G.H.; Chmelka, B.F.; Stucky, G.D. *Science* **1998,** *279,* 548-552. [3] Inagaki, S.; Guan, S.; Ohsuma, T.; Terasaki, O. *Nature* **2002**, *416*, 304-307.[4] Ide, M.; Wallaert, E.; Van Driessche, I.; Lynen, F.; Sandra, P.; Van Der Voort, P.; *Microporous and mesoporous materials* **2010**, DOI: 10.1016/j.micromeso.2010.12.013.